Although these do not give us the details as seen by the unaided eye, or as photographed on a small scale, they serve to show the structure of the lower corona. It is difficult, however, for reproductions such as these to do justice to the original negatives, as much of the fine detail is lost in the process. Prof. Campbell, it will be remembered, was stationed at Jeur, and his chief instrument was a large photographic telescope of 5 inches aperture and 40 feet focal length, the instrument being fixed, and the photographic plate made to follow the sun.

THE PLANKTON OF LAKE MENDOTA.

THE natural history of small lakes has long offered a most promising field for research in an important department of biology, viz. the inter-relations of species of plants and animals in the struggle for existence, and the dependence of both upon the physical factors of their environment. As compared with the majority of land and sea areas, a small lake constitutes a relatively perfect "unit of environment," the different elements of which can be determined with an accuracy impossible in most other cases. It is on this account, we suppose, that the detailed study of lake plankton has rapidly gained so many votaries since the lines of quantitative investigation were laid down by Dr. Zacharias and his pupils. In America, especially, the investigation of lacustrine plankton has been taken up with zeal by a considerable army of workers, the vast network of lakes in the basin of the St. Lawrence and the upper reaches of the Mississippi providing unrivalled opportunities for the most diversified inquiries. The latest[1] contribution upon this subject is at least as interesting as its predecessors, and we propose here to give a short account of Prof. Birge's principal results.

Lake Mendota is a sheet of water 6 miles in length by 4 in width, of moderately uniform depth, varying from about 18 to 24 metres, and without any large affluent. During the winter the lake is usually frozen over for three or four months. In the present memoir Prof. Birge gives an account of the Crustacea of the plankton of this lake. He deals firstly with the seasonal and annual changes in the frequency of the Crustacean constituents of the fauna, and secondly with the horizontal and vertical distribution of the total Crustacean population and of the individual species. In each case he discusses the nature and influence of the various factors which operate in the production of the observed changes. Serial observations and collections were made during a period of two and a half years.

Neglecting isolated individuals, the Crustacean fauna of Lake Mendota consists of eight well-represented species, which may be grouped as (*a*) perennial and (*b*) periodic. The perennial group includes three species of Copepoda (*Diaptomus Oregonensis*, *Cyclops brevispinosus* and *C. Leuckartii*), and two species of Cladocera (*Daphnia hyalina* and *Chydorus sphæricus*). The periodic group consists entirely of Cladocera (viz. *Daphnia pulex*, *D. retrocurva*, and *Diaphanosoma brachyurum*).

Prof. Birge shows by an elaborate series of curves and figures that the Crustacean population undergoes a cycle of seasonal changes which is regularly repeated in successive years—three periods of increase alternating with three periods of decrease in the course of each year. The maxima occur in spring (May), midsummer (July), and autumn (September and October); the minima in winter (December to April), early summer (June or early July), and late summer (late July or August).

The spring maximum is by far the greatest, and is due mainly to the rapid and preponderating increase of *Cyclops brevispinosus*. The summer depression is due to a subsequent rapid decline in the numbers of this species. Renewed reproductive activity on the part of other perennial species leads to the midsummer maximum, which is succeeded by a slow decline, reaching a point of greatest depression towards the end of August. During this period of decline most of the periodic species are introduced, but their numbers do not, as a rule, compensate for the falling off in the number of the permanent species. In this respect Lake Mendota appears to be peculiar, for it often happens in other lakes that the periodic forms are the dominant members of the summer population. The September rise is caused chiefly by the multiplication of *Daphnia* of all species and of *Cyclops*. The rapidity of the subsequent decline to the winter minimum is dependent on a number of different conditions, such as the abundance of the periodic forms present, the rate of fall of temperature, storms, &c. It varies therefore in successive years. But while the absolute number of Crustacea present, and the rapidity of the seasonal changes themselves, vary considerably in successive years, it is undoubtedly an interesting fact, clearly established by Prof. Birge's researches, that the general character of the vicissitudes of the floating population of the lake is remarkably constant from year to year.

The principal factors which determine the numbers of Crustacea in different years are, according to Prof. Birge, (1) food supply, both quantity and quality, (2) temperature, and (3) competition. It would appear that of these factors, the temperature of the water exerts a greater control over the number of Crustacea than does the food, since the number of Crustacea falls off in autumn while food is still abundant. The influence of temperature is felt through its effects upon the reproductive powers of the Crustacea, increased warmth favouring rapid multiplication.

So far as the food supply of the Crustacea is concerned, Prof. Birge assures us that the actual quantity of microscopic plant-life in Lake Mendota is almost always in excess of the demands of the Crustacea. A scarcity of food is brought about by changes in the quality rather than in the quantity of the algæ present, since some forms are more available than others as food for particular species or stages of Copepods or Cladocera. For example, young Crustacea are quite unable to eat *Ceratium* on account of its large size and its hard shell; consequently the regular predominance of *Ceratium* in the late summer is one of the principal causes which brings about the annual decline in the number of Crustacea at this season of the year. The Cladoceran *Chydorus* remains scarce while diatoms or *Ceratium* are the predominant algæ, but abounds when the place of these algæ is taken by Schizophyceæ or *Anabæna*. In seasons when the inedible filaments of *Lyngbya* predominate, there is a marked reduction in the numbers of all Crustacea present, except *Diaptomus*, which manages to maintain its numbers by combining great locomotive powers with effective means of catching food.

Equally interesting is Prof. Birge's account of the vertical distribution of Crustacea in the lake at different seasons. In winter, corresponding with the homothermous condition of the water, the Crustacea are uniformly distributed; but in summer the formation of the "thermocline" (or boundary between the upper stratum of warm, and the lower stratum of cold water) leads to a distinct stratification of the lake into layers inhabited by different types. The layers undergo changes in thickness as the thermocline descends, and these changes affect the distribution of the Crustacea to a marked degree. Moreover the layer of cold water below the thermocline becomes largely exhausted of oxygen by the decomposition of dead plants and animals which sink into this stagnant zone; and it is on this account, rather than on account of the difference in temperature, that the layer below the thermocline becomes largely destitute of Crustacean life. Insect larvæ, however, such as *Corethra*, may nevertheless be found in considerable number below the thermocline, obviously because they can carry a stock of air in their breathing tubes.

Space will not admit of further references, but we have perhaps extracted enough from this excellent memoir to justify our opening remark that the careful study of lake plankton is well worth the expenditure of time and labour such as the author of the memoir before us has clearly devoted to it.

W. G.

DESTRUCTION OF THE FRENCH OBSERVATORY IN MADAGASCAR.

AN interesting account of the destruction of the French Observatory in Madagascar is contributed by M. E. Colin to a recent number of *Cosmos*.

In October 1895, after the rupture between the Governments of France and Madagascar, the colonists and missionaries of the former country were requested to leave Antananarivo. The observatory of Ambohidempona, belonging to the French Catholic Mission, was entrusted to the care of the Prime Minister by the priest Mgr. Cazet, together with all the instruments. The two natives, who acted as computers, were instructed to continue the series of observations commenced in 1889. Matters went well and quietly for a time; but after about nine months had elapsed a rumour was circulated by an Indian, a British subject, to the effect that the French before leaving had

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[1] "Plankton Studies on Lake Mendota. II. The Crustacea of the Plankton, July 1894–December 1896." By E. A. Birge, Ph.D., Sc.D., Professor of Zoology, University of Wisconsin. (*Trans. Wisconsin Acad. Sci.*, xi., 1897, pp. 274 to 448.)

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hidden a lot of war materials in the cellars of the observatory. After a thorough inspection an electric battery was found in the cellars. However, the absence of instruments of destruction did not allay the suspicions, especially as the story was told at the time the French soldiers were approaching Antanánarivo.

In August, the Madagascan Government sent M. Ramarosaona to make a complete search over the observatory. He found in the north tower six cases with the following inscription on them: "Produits chimiques et photographiques, Brewer Frères, Paris," and at once concluded that this was the ammunition, deciding that the two copper-mounted telescopes were the cannons, and he announced his discovery to the Prime Minister with much pride. The Prime Minister, however, knew that the instruments were really telescopes and not cannons, and expressed the wish to look through one. On seeing how clearly distant objects could be observed, he at once concluded that the instruments were used for watching the manœuvres of the French soldiers. All suspicious instruments and boxes were then taken to the palace; inspectors were frequently sent to the observatory to try and find the hidden war material, but to no effect.

Finally, in September an order was issued from the Queen that the inhabitants of the neighbouring villages were to take the instruments and furniture of the observatory to the college at Ambohipo, and to destroy the observatory, in order that the French, who were advancing on the town, should not find a single shelter. With all possible speed the two men in charge dismounted as many instruments as possible, and packed them ready for transport. The inhabitants, however, were already in the buildings breaking down windows and doors, so that many instruments were broken, and others disappeared. The meteorological observations were continued up to the last moment, and much credit is due to the two assistants, who were indefatigable in their efforts to save as much as possible.

Soon after the destruction of the observatory, of which only a few feet of the walls were left, the French arrived, and an engagement followed between them and the Madagascans; and the position of the latter became so bad that they had to escape to Antanánarivo, leaving behind them their cannons and ammunition, which were afterwards used by the French to bombard the palace.

The next day an inspection was made of the instruments at the college, but most of them were found to have been damaged in transport; so much so, that it was either a case of sending them to France to be mended, or of replacing them by new ones. Most of the other instruments that were taken were returned, and in some cases money was sent to compensate for damages.

The observatory had been at work for a little over six years, and during that time very important observations in meteorology, astronomy, magnetics and geodesy had been made. A subscription is now open for a new observatory and for the College of France at Antanánarivo, and in all probability the new observatory will be dedicated to the memory of the soldiers killed in Madagascar.

TIDES IN THE GULF AND RIVER ST. LAWRENCE.

WE have received a copy of a paper[1] read before the Royal Society of Canada, giving a general description of the results of the tidal observations which are being carried out in the St. Lawrence under the direction of the Canadian Government. In NATURE of April 22, 1897, an account was given as to the origin of this survey and the manner in which the operations were being conducted by Mr. Bell Dawson, the officer in charge of the work, under the direction of the Marine Department of the Dominion. One of the principal objects of the survey is to obtain, by means of self-recording tide-gauges, data for computing trustworthy tide-tables for the use of the navigation.

Tide-tables for two of the stations—Halifax and Quebec—have been issued for the last two years, and for St. John for the present year. Owing to the great variation of the rise and time of the tides at different parts of the Gulf, the pamphlet affords an extremely interesting study of tidal conditions. The regularity with which the tide proceeds to Quebec after it has once entered the mouth of the river is in great contrast with its character while in the Gulf.

The variation in the period of time which the tidal undulation occupies in crossing the open Gulf is twice as great as the variation in the period between Anticosti and Quebec, where the distance is double. The main set of the tide is along the deep-water channel of 100 fathoms, which continues up the river to the mouth of the Saguenay, 130 miles below Quebec. Along the 240 miles from St. Paul Island in Cabot Strait to Anticosti the tide is propagated at the rate of 43 miles an hour; whereas over the 450 miles from Anticosti to Quebec the rate is 82 miles an hour. The variation in the range of the tide at different parts of the Gulf and river is even more varied. At some of the stations and in the Atlantic the range is from 4 to 5 feet. At Magdalen Island, in the middle of the Gulf, and also in parts of Northumberland Strait, the rise is almost imperceptible; while at Quebec and St. John the range is 26 and 32 feet. The wind is also found to have a material effect on the range and time of the tides, which are delayed or advanced from 1½ to 2 hours in some parts of the Gulf, according to its direction and force. The pamphlet is accompanied by a map of the Gulf and several tidal diagrams.

THE DUKE OF DEVONSHIRE ON UNIVERSITY EXTENSION.

A CONFERENCE on University Extension was held in Cambridge last week, and on Thursday, the second day of the proceedings, the Duke of Devonshire presided, and delivered an address, portions of which, taken from the *Times* report, we reproduce:—

LOCAL EXTENSION COLLEGES.

The most important outcome of University extension during the last few years has been the light which it has thrown on the possibility of coordinating, where the circumstances are favourable, various forms of adult education. A few weeks ago his Royal Highness the Prince of Wales opened the new buildings of the University Extension College at Reading, and the presence of a large and distinguished body of representatives of the University of Oxford showed the deep interest taken by the sister University in this new institution, which is the direct result of the University extension movement aided and supported by municipal contributions, local generosity, and the subsidies of the neighbouring County Councils. Special local circumstances and the encouragement given by the Board of Agriculture have given a particular character to the organisation of the Reading College; but the essential fact in its rapid and striking growth has been the part played by the representatives of the University in organising and stimulating local effort and in educing out of various elements a new type of educational institution which associates municipal and local activity with University traditions and prestige. The successful growth of the Exeter University Extension College, which stands in a close relation to the University of Cambridge, and largely owes its increasing educational importance to that connection, is another proof the value of the services which the Universities are rendering to this branch of national education. The differences in the organisation of the Reading and Exeter Colleges show how wisely the methods of University extension work have been allowed to adapt themselves to the various conditions of distinct localities. The operations of the University syndicates have been happily marked by a judicious sense of the need for elasticity and freedom in educational organisation, coupled with an earnest care for high aims and for a high standing of teaching. A good beginning has also been made, in close connection with the University of Cambridge, at Colchester, where the new University Extension College will, it may be hoped, render excellent educational service to the municipality and surrounding neighbourhood.

A VINDICATION OF THE EXTENSION MOVEMENT.

Apart from providing guidance and stimulus in studies for those who would otherwise be deprived of them, the University Extension colleges and courses have proved of great advantage to many who desire to keep up their intellectual interests and to refresh their knowledge. Teachers in the various grades of schools, public and private, are among those who have had

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[1] "Character and Progress of the Tides in the Gulf and River St. Lawrence, as ascertained by Simultaneous Observations with Self-registering Tide-Gauges." By W. Bell Dawson, M.A., Assoc. M. Inst. C.E. (Ottawa: J. Durie and Son. London: Bernard Quaritch, 1897.)

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